MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022

BDS 4614 – MANAGEMENT DECISION SCIENCE

(All sections/Groups)

19 AUGUST 2022
9.00 a.m – 12.00 p.m
(3 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **5** printed pages excluding the cover page, with **5** questions only.

2. Attempt **ALL** the questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Students are allowed to use non-programmable scientific calculators (without restriction).

4. All necessary workings must be shown and please write all your answers in the answer booklet provided.

QUESTION 1

A company manufactures three types of patio furniture: chairs, rockers and chaise lounges. Each chair requires 1 unit of wood, 1 unit of plastic and 2 units of aluminium; each rocker requires 1 unit of wood, 1 unit of plastic and 3 units of aluminium; Chaise lounge requires 1 unit of wood, 2 units of plastic and 5 units of aluminium. The company has 400 units of wood, 500 units of plastic and 1450 units of aluminium. Each chair, rocker, chaise lounge sells at $21, $24 and $36 respectively. Assume that all furniture can be sold.

a) Formulate the above problem as a linear programming model. [4 marks]

b) Set up the initial simplex tableau by including necessary slack variables. [2 marks]

For sub-questions c, d, e, f, g refer to the following final table:

C_j →		21	24	36	0	0	0	
↓	***Solution Mix***	X_1	X_2	X_3	S_1	S_2	S_3	***Quantity***
24	X_2	1	1	0	2	-1	0	300
36	X_3	0	0	1	-1	1	0	100
0	S_3	-1	0	0	-1	-2	1	50
	Z_j	24	24	36	12	12	0	10800
	$C_j - Z_j$	-3	0	0	-12	-12	0	

S_1 - Slack for wood available
S_2 - Slack for the plastic available
S_3 - Slack for the aluminium available

c) What is the optimal solution and the maximum profit? [2 marks]

d) Which of the constraints are binding? Why? [3 marks]

e) What are the shadow prices of the constraints and explain what it means [2 marks]

f) What is the range of optimality for the profit contribution of rockers? [4 marks]

g) Over what range the amount of wood can vary without changing the dual price? [3 marks]

[Total 20 marks]

Continued...

QUESTION 2

a) ABC Milk Tea is a chain store with branches in Melaka, KL, Penang, and Johor. The owner of ABC Milk Tea has decided to open new branches in Perak, Pahang, Perlis, and Selangor. To ensure the quality of the service provided by the new branches, the owner plans to transfer staff from the existing branches to the new branches to train the new team. The number of staff agreed to be transferred for each branch, the number of staff needed for each new branch, and the reallocating cost per staff are as follows.

TO / FROM	Perak	Pahang	Perlis	Selangor	Number of Staff Available
Melaka	1000	700	1000	700	12
KL	800	600	800	500	18
Penang	800	800	800	800	10
Johor	1500	700	1100	X	5
Number of Staff Require	10	10	13	12	

The "X" indicates that staff from Johor should not be transferred to Selangor. Use VAM to find an initial solution and then apply the MODI technique to find the least-cost distribution system. Determine the minimum total cost.

[10 marks]

b) A local package delivery company received an urgent request to collect parcels from five locations. Five staff are available to pick up the parcels, but the time needed to pick up the parcels is different due to their locations. The time required (minutes) for each staff to pick up the parcels is presented in the following table

Staff	Location				
	Ayer Keroh	Melaka Raya	Cheng	Alor Gajah	Durian Tunggal
Andy	24	32	20	55	50
Brondon	15	27	30	60	50
Chan	5	25	25	45	40
Dennis	20	30	20	40	35
Evan	25	20	35	50	45

Find the optimal assignment plan that gives the shortest pick-up time.

[10 marks]

[Total 20 marks]

Continued...

QUESTION 3

A construction company is estimating the time needed to complete a new project. The construction team has identified all the important activities and named them from A to J. Besides, to estimate the project completion time, the company has further estimated the following information:

Activity	Immediate Activity	Time (weeks)		
		Optimistic	Most Likely	Pessimistic
A	-	5	7	12
B	-	4	6	8
C	-	4	6	8
D	A	6	10	14
E	B	10	12	14
F	B,C	5	9	10
G	D,E	5	10	15
H	F	5	7	12
I	G,H	7	13	16
J	F	10	15	17

a) Draw a network diagram to represent the project. [5 marks]
b) Compute the expected time and the variance for each activity. [4 marks]
c) Determine the critical path and the expected completion time for the project. [6 marks]
d) Calculate the variance in the expected completion time for the project. [2 marks]
e) Determine the probability that the project can be completed within 42 weeks? [3 marks]

[Total 20 marks]

QUESTION 4

Sam Stewart, the owner and manager of a hardware store is reassessing his inventory policy for hammers. The annual demand of the hammers is 600 and he has been placing an order to purchase 50 hammers from a wholesaler at a cost of $20 per hammer at the end of each month. However, Sam does all the ordering for the store himself and finds that this is taking a great deal of his time. The store operates 300 days a year and cost of placing each order for hammers is $15.

a. In order for the current ordering policy to be optimal according to the EOQ model what would be the unit holding cost for the hammers? [4 marks]
b. Determine the optimal order quantity if the unit holding cost actually is 20 percent of the unit acquisition cost. [2 marks]
c. What is the total inventory cost based on the optimal order quantity in (b)? [4 marks]

Continued...

d. If the wholesaler typically delivers an order of hammers in 5 working days, what should the reorder point be? [3 marks]

e. Determine the time between orders. [3 marks]

f. The wholesaler offers a discount of 5% if Sam buys in a lot of 100 or more, should he accept the offer? [4 marks]

[Total 20 marks]

QUESTION 5

A farmer must decide which crop to plant next year on his land: corn, peanuts or soybeans. The return from each crop will be determined by the demand of the crops in the food market. The profit the farmer will realize from each crop, given the various market conditions is shown in the following payoff table:

	Demand		
Crop	Good	Fair	Bad
Corn	$35,000	$20,000	$ 8,000
Peanuts	18,000	12,000	10,000
Soybeans	22,000	20,000	15,000
Probability	0.3	0.4	0.3

i. Determine the best crop to plant, using the following decision criteria:
   a. Maximax [2 marks]
   b. Maximin [2 marks]
   c. Hurwicz criterion of realism ($\alpha = 0.3$) [3 marks]
   d. Equal likelihood [3 marks]
   e. Minimax Regret [4 marks]
   f. Expected Monetary Value [3 marks]

ii. How much the farmer would to be willing to pay a market research firm in order to obtain better information about the future market condition. [3 marks]

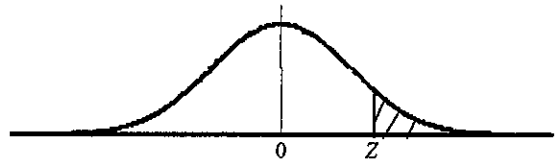
[Total 20 marks]

End of paper.

APPENDIX:

Table 1

The Upper Tail Area Under the Standard Normal Curve



Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
3.5	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
3.6	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.7	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.8	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
3.9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000